

DOD Vehicle Workshop

Supplier Perspective: Paints & Finishes for Corrosion Protection of Military Vehicles

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Burkard Industries, Inc.

*Best Choice for
E-Coat, Powder Coat, Liquid Paint, & CARC*



Background

Burkard Industries has been in business for 76 years, and has been in the finishing business for the last 40 years.

- **Burkard provides coating services to both military and automotive.**
- **Military prime contractor approvals include BAE Systems, Oshkosh Truck, General Dynamics, AM General.**
- **Automotive approvals include Honda, Toyota, General Motors, Ford, Chrysler, BMW, Subaru, Nissan.**
- **Substrates processed include steel, aluminum, armor, magnesium, titanium, and composites.**
- **Facility is 78,000 square feet.**
- **Facility processes over 100,000 parts per day.**
- **Approximately 125 employees.**

Cost of Corrosion

It is well known that the Cost of Corrosion to the Department of Defense is approximately \$20 BILLION per year.

- There are opportunities to learn from the automotive industry which has become a leader in corrosion prevention.
- 25 years ago cars and trucks were not expected to last...



Automotive Today

- Driving from the dealer's lot to the Ziebart shop has become a thing of the past.
- Automotive has become a leader in corrosion prevention.
- Vehicles last much longer due to improved paint systems. Much of this is attributed to improved primer systems.
- Most Automotive OEM specifications include cyclic corrosion testing, hot water immersion testing, 800 to 1,000 + hour salt spray testing.
- Automotive OEM's working with pretreatment companies to develop superior pretreatment processes while improving costs.



**What is the number one factor
for the improvement in
automotive corrosion
performance?**

**All of the Automotive companies now
use e-coat as the primary primer on
the entire vehicle.**

What is *E-Coat*?

- E-Coat stands for electrodeposition coating.
- E-Coat is an immersion based priming system that is applied by electrodeposition.
- E-Coat is an epoxy, water based paint system.
- Utilized by automotive as a primer and as a stand alone under the hood coating.

E-Coat as a CARC Primer

ADVANTAGES

- ✓ *Superior Quality*
- ✓ *Best Cost Solution*
- ✓ *High Throughput*
- ✓ *Environmentally Friendly*

E-Coat Advantages

Immersion process provides 100% consistent coverage – including areas a spray primer cannot penetrate

Immersion process provides consistent film build

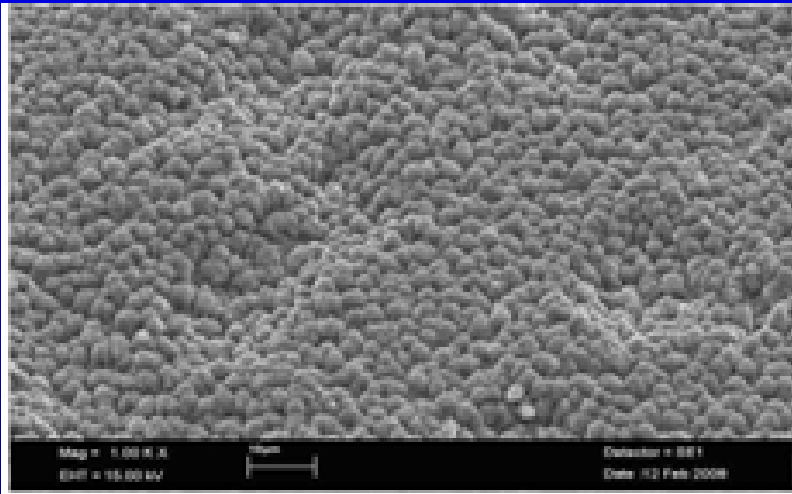


E-Coat Advantages

- Immersion process also provides for best cost solution – no overspray so 98% material utilization.
- Environmentally friendly – HAPS free and very low VOC (.6 lbs/gallon)
- Military approval under MIL-P-53084.

E-Coat Advantages

Pretreatment systems will generally be immersion zinc phosphate. This is superior to what is generally found on the majority of paint lines set up for liquid spraying.



Zinc Phosphate Crystal Structure:
Consistent and small crystals provides
Best adhesion & superior corrosion resistance.



14 stage immersion pretreatment system

E-Coat Advantages



Some part configurations are difficult to spray due to line of sight issues, but the e-coat primer will provide full coverage between the tube and step.

E-Coat Advantages

Rear Bumper Rusting
HO27 191856
August 04 2009



**Part processed with 53022 primer that
should have been e-coated**

Coaters Perspective:

We often have to paint the parts with an inferior coating system due to contract limitations, or improper paint specifications. This puts the coater in a frustrating position when better technology is available.

The good news is that the better performing priming solution is less expensive than the current spray based primer systems.

What Needs to Happen?

FIRST STEP:

GETTING THE CONTRACTING AGENCIES, PRIME CONTRACTORS, AND SPECIFICATION AUTHORS TO ALLOW E-COAT AS A SUBSTITUTE FOR 53022 SPRAY PRIMER WHERE IT APPLIES.

THIS HAS BEEN DONE WITH FMTV TACOM DRAWING 12420325

METHOD 1: TT-C-490E ZINC PHOSPHATE, MIL-P-53084 E-COAT, MIL-DTL-53039 CARC

METHOD 2: MIL-DTL-5541 CHROMATE CONVERSION COATING, MIL-P-53084 E-COAT, MIL-DTL-53039 CARC

METHOD 4: TT-C-490E ZINC PHOSPHATE, MIL-DTL-53022 PRIMER, MIL-DTL-53039 CARC

METHOD 1 MAY BE SUBSTITUTED FOR METHOD 4

METHOD 10: MIL-DTL-5541 CHROMATE CONVERSION COATING, MIL-DTL-53022 PRIMER, MIL-DTL-53039 CARC

METHOD 2 MAY BE SUBSTITUTED FOR METHOD 10

Arvin Meritor's paint specifications allow the choice of e-coat as a primer, whenever MIL-DTL-53022 is called out.

What Needs to Happen?

SECOND STEP: MAKING E-COAT THE PREFERRED COATING OVER THE 53022 PRIMER FOR ALL COMPONENTS WHERE IT IS A VIABLE SOLUTION.

E-COAT IS A PROVEN AND SURE WAY TO ATTACK THE \$20 BILLION CORROSION PROBLEM WE HAVE.

THE PERFORMANCE PROPERTIES, ALONG WITH ITS LOW COST AND ENVIRONMENTAL PROPERTIES MAKE E-COAT A PREFERRED SOLUTION FOR PRIMING OF MANY PART CONFIGURATIONS OVER ANY LIQUID OR POWDER TECHNOLOGY.

POWDER PRIMERS SHOULD BE EVALUATED FOR APPLICATIONS WHERE E-COAT IS NOT A FIT.

Alternative Solutions:

POWDER COATING

Powder Coating is another technology widely used in automotive.

Powder Coating for Military Components:

- Primer
- Interior Top Coat
- Exterior CARC Top Coat (Future?)

For parts that do not lend themselves to e-coat, (tubes, lots of masking, or complex configurations that will not drain, powder coat primer can be a viable option to increase the salt spray resistance while lowering cost.

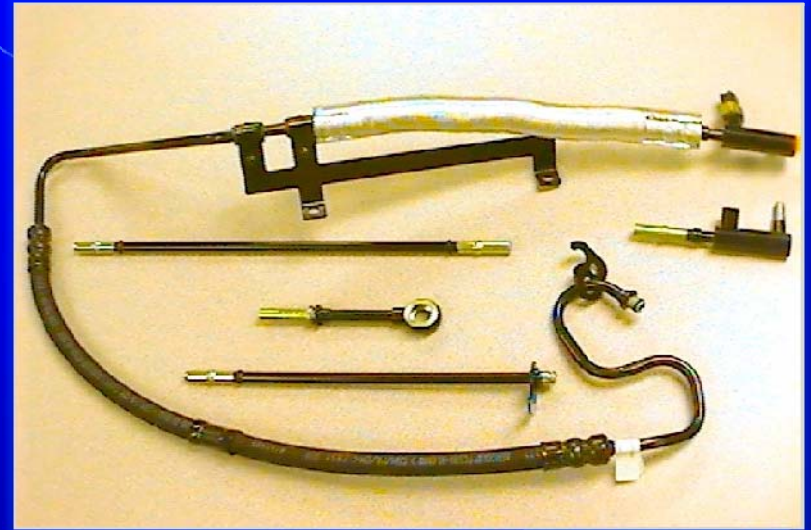
Powder coat has environmental benefits over liquid as well.

Alternative Solutions:

POWDER COATING

Powder Coating Applications:

- Primer
- Interior Top Coat



Best Part Configurations for Powder Coating:

- tubes
- parts with lots of masking
- assemblies

Powder coat has environmental and cost benefits as well.

Liquid primers

- 53022 primer and other liquid primers will always have their place for the military market. Areas where liquid primer is preferred over e-coat or powder primers:
 - Substrates that are heat sensitive.
 - Heavy components that are difficult to get to higher cure temperatures.
 - Parts where part size is larger than available e-coat or powder coat line. Large booths available for complete vehicle painting.
 - Assemblies or vehicles.
 - Touch up or spot priming prior to CARC.

Utilizing Automotive Technologies Coating Magnesium

- Historically GM used an aluminum conversion coating to pretreat magnesium parts.
 - They experienced costly warranty claims due to intermittent failures of the conversion coating.
- Today GM uses a process called Anomag for the pretreatment of magnesium parts.

Anomag with Powder Top Coat

General Motors – *Corvette C6 and Z06 Removable Rooftop*
Class A finish requirement over magnesium.



More than 250,000 magnesium castings for the Corvette removable roof top have been processed without a single paint adhesion defect.

Utilizing Automotive Technologies

ANOMAG PROCESS

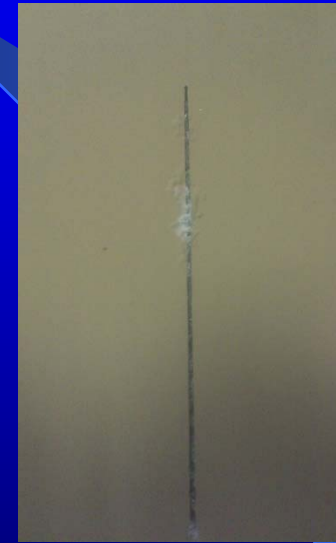
- Electrochemical process which converts the surface of magnesium to a magnesium phosphate compound.
- Anomag is a high energy process topping out at about 400 Volts resulting in a very robust finishing method for magnesium.
- Unlike conversion coatings which require an absolutely clean, oxide free surface, die lubricates, oxidation, or other surface contaminants will not impede the formation of the coating.
- Anomag forms on a molecular level and penetrates as well as builds up on the surface. (2/3 penetrate, 1/3 build)



Utilizing Automotive Technologies

ANOMAG PHYSICAL PROPERTIES

- Coating thickness ranges from 5 to 25 microns.
- Wear resistance of the coating is fair to good.
- 5 to 15 microns is sufficient to form an outstanding base for subsequent top coats or adhesive bonding.
- Magnification reveals microscopic pores and fissures which are responsible for the superior bonding characteristics.
- Natural color is opaque white.
- Anomag is “self healing”. Deeply scribed and down to the substrate and salt spray testing for creep corrosion is excellent.



**Anomag with e-coat
and CARC after 5,376
hour salt spray test.**

Military Compliance

Military specification compliant pretreatment, prime and topcoat operations are essential for long term corrosion protection.



Military Compliance

ISSUES WITH INFERIOR APPLICATORS

- Many corrosion problems can be attributed to poor practices in the coating operation.
- Specification compliance is critical throughout the pretreatment and painting operations.
- Failure to follow specifications leads to failures in the field.

Military Compliance

EXAMPLE OF AN INFERIOR PROCESS

Some coaters are utilizing non-QPLed products for pretreatment of aluminum. These technologies do not meet all of the requirements of MIL-DTL-5541, the military specification for aluminum conversion coatings. They can be applied in less stages and without waste treatment so there is a cost advantage to the non-compliant coater.

These products are usually adhesion promoters but do not provide corrosion protection. The latest Trivalent Chrome Pretreatments on the QPL list will outperform these chrome free products for both adhesion and corrosion. Since MIL-DTL-5541 does not require a TACOM approval, as the zinc phosphate specification requires, many coaters go unchecked.

Military Compliance

A COMPLIANT ALTERNATIVE

MIL-DTL-5541

Aluminum pretreatment conveyor system using a trivalent chrome pretreatment conversion coating.

Non-Etching
Cleaner

Rinse

Deoxidizer

Rinse

RO
Rinse

TCP
Conversion
Coating

DI
Rinse

Military Compliance

Key Steps to Ensure Compliance

- OEM Approved Supplier Lists

Many OEM's require all coating to go through coaters on their approved list. This ensures the product they receive meet specification requirements. Most lists will include capabilities, and the more exclusive the list, generally the higher quality product that OEM will receive from their subcontractors.

- TACOM Process Approvals

TT-C-490 requires TACOM approval. Consider the same for MIL-DTL-5541 for aluminum pretreatment and for MIL-DTL-53072 for CARC application.

- DCMA Coater Audits

DCMA currently pulls contracts and will audit suppliers on that contract. This includes painters. The more audits that are done and the more that they can be tied to OEM Approval lists, the higher the overall coating standards will be throughout the industry. This not only “levels the playing field”, but will have a direct reduction on field failures and corrosion costs.

Conclusion

If we want to minimize the \$20 billion dollars annually spent on corrosion the military community needs to be aggressive in the following areas:

1. DOD should make E-Coat the default primer solution where applicable.
2. Propagate the use of Powder Coat as a primer and as an interior top coat. Continue R&D for CARC Powder Topcoat.
3. Capitalize on the automotive research in new pretreatment technologies with a focus on performance.
4. Prime contractors should maintain strict approval lists and standards for coaters applying coatings to their vehicles and components.
5. DCMA needs to continue efforts to audit the coating applicators to ensure compliance.

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Thank You